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ABSTRACT

The effects of five environmental and five institutional factors on college and university enrollments during the period between 1975-1976 and 1980-1981 were studied with a sample of 2,101 institutions. The environmental factors were federal student aid, state student aid, number of 18-year-olds, unemployment, and level of economic wealth as characterized by average weekly earnings. The institutional factors were selected to represent the manner in which colleges and universities have positioned themselves within their environment. The institutional factors were: percentage of total students enrolled on a part-time basis, tuition and fees, admissions selectivity, percent of in-state students, and program emphasis as characterized by percent of degrees awarded in the humanities, social sciences, and education. A lagged enrollment variable was included to control for differences in institutional size and to study the effect of the direction and magnitude of past enrollment change on current enrollments. A pooled cross-sectional time series regression design was used to analyze the data. Separate regressions were run for public and private two- and four-year colleges and for major doctoral, comprehensive, and general baccalaureate institutions. (SW)

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A REPORT ON THE EFFECTS OF ENVIRONMENTAL AND INSTITUTIONAL FACTORS ON COLLEGE AND UNIVERSITY ENROLLMENTS

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A Report on the Effects of Environmental and Institutional Factors on College and University Enrollments

Summary and Conclusions

This study examined the effects of selected environmental and institutional factors on college and university enrollments. The information derived from the study should prove useful in policy deliberations concerning higher education, particularly with respect to federal student aid. The information should have value in two respects. First, the analyses identify and determine the relative impact of selected factors, including federal student aid, on college and university enrollments. Second, the analyses show how the impact of these factors varies across different sectors of the institutional population. In short, the study provides an empirical context in which the potential effects of education policy on the enrollments of colleges and universities can be better understood.

Briefly, the study examined the relative impact of five environmental factors and five institutional factors on institutional enrollments during the period between 1975-76 and 1980-81. The environmental factors included in the analysis were federal student aid, state student aid, number of 18 year olds, unemployment, and level of economic wealth as characterized by average weekly earnings. The institutional factors were selected to represent the manner in which colleges and universities have positioned themselves within their environment. The institutional factors incorporated into the study were percentage of total students enrolled on a part-time basis, tuition and fees, admissions selectivity, percent of in-state students,

and program emphasis as characterized as percent degrees awarded in the humanities, social sciences and education. A lagged enrollment variable was also included in the analysis to control for differences in institutional size and to study the effect of the direction and magnitude of past enrollment change on current enrollments.

A pooled cross sectional time series regression design was used to analyze the data. Separate regressions were run for public and private two and four-year institutions to allow for comparisons among these groups; and for major doctoral, comprehensive, and general baccalaureate institutions within the public and private four-year sectors of higher education. The results of these analyses are summarized in Table 1 and are discussed below.

Summary of the Findings

1. The lagged enrollment variable was found to be a significant predictor for all sample groups. This finding suggests that the direction of enrollment change from one year will carry over to the next but at a decreasing rate. Comparison of the results for two and four-year institutions shows that the momentum of enrollment change over time has a more pronounced effect on four-year institutions than on two-year institutions.

2. Of the variables representing environmental conditions, federal student aid was most consistently related to enrollments across the various sectors of the institutional population. With the exceptions of the private general baccalaureate and the private two-year institutions, federal student aid was found to have a positive relationship with institutional enrollments. Conversely, state student

Table 1

Summary of the Relationships between the Environmental and Institutional Factors and Institutional Enrollments by Institutional Sector

Variables	Public Institutions					Private Institutions				
	Two-year	Four-year	M.D.	COMP.	GBA	Two-year	Four-year	M.D.	COMP.	GBA
Previous year's enrollment	+	+	+	+	+	+	+	+	+	+
Federal student aid		+	+	+	+		+	+	+	
State student aid										
Size of the 18 year old population	-			-						
Average weekly earnings	-	-	-	-						
Unemployment		+		+	+					
INSTITUTIONAL FACTORS										
Percent part-time FTE	+	+	+	+	+			+		
Program emphasis on humanities, social sciences and educ.			+							-
Tuition and fees		-		-				-	-	
Admissions selectivity		+	+							
Percent in-state students			+			+				

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aid was not found to have a significant impact on enrollments in any sector of the institutional population.

3. The size of the 18 year old population was inversely related to enrollments in the public comprehensive and public two-year sectors. This anomalous finding indicated that enrollments increased in these institutions as the size of the 18 year old population decreased. A number of possible explanations for this result are discussed in the body of the report.

4. The two variables representing economic conditions, average weekly earnings and unemployment, were found to have a significant impact on institutional enrollments in the public sector. The results indicated that the level of economic wealth in a region, as represented by average weekly earnings, was negatively related to enrollments in all the institutional public sectors with the exception of the public general baccalaureate institution grouping. This indicated that institutional enrollments decreased as the level of economic wealth in a region increased. Enrollments in private institutions were found to be unrelated to the level of economic wealth. Unemployment was found to be positively related to enrollments in the public four-year sector, specifically with enrollments of public comprehensive and general baccalaureate institutions. This finding indicated that enrollments in these institutional sectors increased as unemployment increased. In contrast, unemployment was found to have no effect on the enrollments of private institutions.

5. With respect to the variables representing the manner in which institutions positioned themselves within their environment, the percentage of part-time students was found to be positively related to

enrollments across all the public institutional sectors. A significant positive relationship was also found between the enrollments of private major doctoral institutions and part-time enrollments.

6. Program emphasis, as represented by the percent degrees awarded in the humanities, social sciences, and education, was found to have mixed effects across the institutional population. In the public sector, a program emphasis in these areas was found to be positively related to enrollments in the major doctoral sector. In contrast, such a program emphasis was found to have a negative impact on the enrollments of private general baccalaureate institutions, the largest group of institutions in the private sector of higher education.

7. The level of tuition and fees was found to have a negative effect on enrollments in the four-year public sector, and more specifically on enrollments in public comprehensive institutions. The level of tuition and fees was also found to have a negative impact on enrollments in the private major doctoral and comprehensive sectors.

8. Admissions selectivity was positively related to enrollments in the public four-year sector, and the public major doctoral sector in specific. This finding indicated that greater admissions selectivity was related to increasing enrollments within this sector of the institutional population. In contrast, admissions selectivity was found to have no effect on institutional enrollments in the private sector.

9. The percent of in-state students was found to have a significant positive impact on enrollments in the public major doctoral and the private two-year sectors, indicating that enrollments of

institutions within these sectors increased to the extent that these institutions recruited in-state students.

10. The findings indicate that public sector enrollments are more sensitive to prevailing environmental conditions, and that their enrollments are more affected by the manner in which public institutions position themselves in their environment as compared to the enrollments of private institutions.

Conclusions

Two conclusions can be drawn from these results. First, within the context of the time frame employed and the sample included in the study, it is clear that year-to-year changes in institutional enrollments are largely governed by the momentum of institutional enrollments over time. The finding concerning the lagged enrollment variable indicates that institutions with increasing enrollments in one year are likely to experience increasing enrollments in the next year but at a slower rate of increase, all other things equal. Conversely, institutions experiencing decreasing enrollments in one year are likely to experience decreasing enrollments in the next year. In effect, the system tends toward equilibrium over a period of time.

The role that environmental and institutional factors appear to play in this situation is in changing the direction or magnitude of the enrollment change over time. For example, a likely impact of reductions in federal student aid within the context of these results would be a slowing of enrollment growth in institutions that have experienced increasing enrollments and an acceleration of enrollment decline in those institutions experiencing declining enrollments. Similarly, decreasing unemployment would likely have a negative effect

on the enrollments of public four-year institutions. Public comprehensive and general baccalaureate institutions with growing enrollments would most likely experience a slowing of enrollment growth over time as unemployment decreased, while similar institutions with declining enrollments would likely experience acceleration in the decline of enrollments.

Any attempt to extrapolate these findings to the future of higher education enrollments requires that two points be kept in mind. First, extrapolation would assume that the underlying dynamics of enrollment change in the higher education system, as portrayed in this study, remain stable and do not change over the time period in question. It is evident that at least the dynamics concerning the impact of the size of the 18 year old population on institutional enrollments will change over the next few years. For example, Thrift and Toppe (1982) have reported that the participation rate of the traditional college-aged population rate in higher education declined during the fall of 1982 after having increased since the fall of 1978. This change in the underlying dynamics of the higher education system is likely to magnify the detrimental impact of a smaller 18 year old population on institutional enrollments. In relation to the findings of this study, it also suggests that the sign of the relationship between the size of the 18 year old population and enrollments will change from negative to positive. Second, it has to be kept in mind that the study describes the dynamics of the higher education system and the sectors within it. Thus, while the findings accurately portray the dynamics of enrollment change for groups of institutions, caution must be exercised in

applying the findings to the enrollment dynamics of any single institution.

The second conclusion that emerges from the study is that caution has to be exercised in drawing general conclusions about the enrollment dynamics of the institutional population as a whole. The results clearly illustrate that different factors affect public and private institutions, two and four-year institutions, and different types of four-year institutions. Treating all sectors of the institutional population as the same opens the door for miscalculation of the potential effects of educational policy on college and university enrollments.

INTRODUCTION

College and university administrators are faced with a high degree of uncertainty when thinking about the 1980s. Unlike the 1960s when growth was almost assured because of annual increases in the size of the 18-21 year old population and an abundance of funds from governmental and private sources, the 1980s appears to be a period of potential decline. Projections show that the size of the 18-21 year old population will decrease through the 1990s, which is likely to be manifested in reduced enrollments. The stagnation of the economy and the changing role of government in American society are creating uncertainty about the availability of financial resources from both the public and private sectors.

Many individuals have speculated about the prospects for colleges and universities during the 1980s. These visions of the future of higher education vary widely. Boulding (1975) and Dresch (1975), for example, have presented "pessimistic" views of the future which foresee rapidly declining enrollments. Their opinions are primarily based on demographic trends. Other authors, such as Frances (1980a), Leslie (1980), and Leslie and Miller (1974), have presented more "optimistic" views of the future in which institutional enrollments and revenues decline slightly or stabilize at current levels. The opinions of these authors are based on the perception that colleges and universities can adapt to changing environmental conditions by modifying their missions, programs, technologies, and clients served.

Moreover, a number of studies suggest that certain institution-specific factors will moderate the impact of environmental

conditions on institutional enrollments and revenues. Leslie, Grant, and Brown (1981), the Carnegie Council (1980), and Brown, Grant, and Leslie (1979), for example, have suggested that more selective institutions will be affected less by reductions in the size of the 18-21 year old population than will their less selective counterparts. Zammuto (1982) has argued that institutions with more diverse programs are likely to experience greater stability in enrollments than are less diverse institutions as students' interests in fields of study change.

The size of the geographic region served by an institution also may moderate the effects of economic conditions on institutional enrollments and revenues. Studies by Rusk, Leslie, and Brinkman (1982) and by Zammuto (1983) suggest that the larger the geographic region served by an institution, the less susceptible the institutional enrollments appear to be to fluctuations in local economic conditions. Other institutional features, such as the price elasticity of tuition and fees (Jackson and Weathersby, 1975), the level of competition among institutions for students (Zemsky, Shaman and Berberich, 1980; Rowse and Wing, 1982), efforts to recruit part-time students (Mingle and Norris, 1981), and so on, have an impact on how the effects of environmental conditions are manifested in changes in institutional enrollments and revenues.

While it is evident that a large body of speculative and empirical information has been generated, essentially no research has been done on the joint effects of institutional and environmental factors on institutional enrollments or revenues. Most studies, such as those cited, have examined one or two variables in relation to enrollments and revenues and then only for a small number of selected institutions.

Hence, there appears to be no empirical data indicating the relative impact of both these factors on either the system of higher education, or on different types of institutions within the system.

The study reported herein attempts to fill part of this void by simultaneously examining the impact of institutional and environmental factors on year-to-year changes in college and university enrollments. The sample includes 2,101 colleges and universities for which complete data were available for the academic years 1975-76 through 1980-81 from the Higher Education General Information Survey (HEGIS). Comparisons are made between two and four-year institutions in both the public and private sectors. The results of these comparisons are intended to help determine how both institutional and environmental factors have, and may continue to affect institutional enrollments. The following section presents the theoretical framework on which the study is based and an overview of previous research.

Theoretical Framework

The predictions about the future of higher education discussed in the introduction reflect two differing perspectives in organization-environment relations. The "pessimistic" views reflect the reasoning inherent in the population ecology model of organizations (Hannan and Freeman, 1977; Aldrich, 1979; Brittian and Freeman, 1980). Decreases in the size of the traditional college-age population are viewed as having an inexorable effect on college and university enrollments. As the supply of potential students decreases, the enrollments of colleges and universities also will decrease.

The population ecology model is derived from the literature on evolutionary processes in biology. As its name implies, it focuses on

changes in a population of organizations rather than the behavior of individual organizations. Different forms of organization within a population are viewed as variations, some of which are selected and retained within the population as its environment evolves. The result of the process over time is the survival of organizations that exhibit characteristics that best fit the constraints imposed on the population by its environment. Thus, by examining changes in a population over time, an understanding of the features that made some organizations more adaptive than others can be gained. (For a more detailed treatment of the model's application to higher education, see Birnbaum, 1983).[1]

In contrast, the more "optimistic" views of the future reflect a strategic management perspective of organization-environment relations (Child, 1972; Hofer and Schendel, 1978; Kotler and Murphy, 1981). Within this paradigm, organizations are viewed as being able to avoid the inexorable effects of environmental change by tracking the environment and responding to it. In effect, organizations are able to manipulate the impact of changing environmental conditions by the way they position themselves within that environment. Environmental scanning, strategic planning, innovation, and marketing are some of the managerial tools used to accomplish this end.

The purpose of the following analysis is not to determine whether one or the other of the approaches is correct. Indeed, Birnbaum (1983) has shown that neither type of approach is sufficient for explaining the dynamics of change within higher education. Rather, the study treats the approaches as being complimentary. The environment is viewed as creating the context within which colleges and universities

operate. By examining the interplay of institutional and environmental factors, the relative importance of each in affecting college and university enrollments can be determined.

Environmental Factors

The first step in this study was to define the relevant institutional environment. The literature suggests the four major environmental factors that constrain college and university enrollments are: 1) the size of the pool of potential students, 2) the availability of resources for individuals wishing to enroll, 3) the level of economic wealth within a region, and 4) the level of economic activity within a region. The following section briefly outlines the results of research concerning these four factors and how they affect enrollments.

The size of the pool of potential students is a major determinant of college and university enrollments. During the 1970s, over 90 percent of the full-time students were from the 18-21 year old age group (Tierney, 1982). Demographic projections show that the size of the 18-21 year old population will decrease substantially over the next decade. Nationally, there will be about a 20 percent decrease from 1980 through 1990 (U.S. Bureau of the Census, 1975). Further decreases will also occur during the first half of the 1990s before the size of this age group begins to increase during the latter half of that decade. Compounding the effects of the national decline in the size of this age group are regional variations in birth rates and migration patterns. Some states in the sunbelt will have an increasing number of 18-21 year olds, other states in the midwest and northeast will experience 30 to 40 percent decreases.

An analysis of college participation rates by Tierney (1982) illustrates the magnitude of the impact that the reduction in the size of the 18-21 year old population may have on institutional enrollments. He notes that in order to maintain current levels of enrollments nationally through the 1980s, the participation rate for this age group, which was approximately 32 percent in 1979, would have to increase by eight percentage points (or 25 percent) by the end of the decade. Given the magnitude of the decline, it is unlikely that increasing part-time enrollments will be able to totally offset the decline in number of traditional full-time students. Thus the predictions of declining enrollments that are found in the literature.

While the size of the 18-21 year old population provides one indication of the resourcefulness of the college and university environment, other resource factors also need to be taken into account. Other relevant factors are those that affect individuals' decisions on whether to attend college or pursue some other alternative. The rational investment model, which has been used by economists to explain changes in enrollments, is a useful framework for examining the three remaining variables: the resources available to potential students, the level of wealth and the level of economic activity within a region.

Using the rational investment model, Becker (1975) estimated that the return on investment for college attendance ranged between 12 and 15 percent during the late 1950s and 1960s. The rate of return decreased to 7.5 percent by the mid-1970s (Freeman, 1976), and continued to decline throughout the latter half of the decade (Tierney, 1982). The effect of a decreasing rate of return on investment from a college education is that it made employment an attractive alternative

for many potential students. In turn, institutional enrollments became more sensitive to changes in economic conditions (Rusk, Leslie, and Brinkman, 1982).

The availability of student aid and the levels of wealth and economic activity are three factors that appear to influence the perceived rate of return of attending college. Student aid from state and federal sources has the effect of lowering the cost of obtaining a college degree, increasing the perceived rate of return. For example, Leslie (1978) has estimated that the availability of federal student aid added about 250,000 students to private institutional enrollments during 1975-76. The impact of federal student aid on enrollments became even more accentuated during the late 1970s as the amount of funds available increased and as the limits on awards were adjusted upward.

The levels of economic wealth and activity within a region also influence the attractiveness of employment as an alternative to attending college. The level of economic wealth, as represented by average weekly earnings in this study, provides a general indication of the average value of employment as an alternative to attending college. Within the framework of the rational investment model, it is expected that the higher the level of economic wealth within a region, the lower the potential return on college attendance because of the opportunity costs involved.

The level of economic activity within an area also is related to the perceived opportunity costs of attending college. Rusk, Leslie, and Brinkman (1982) found a negative relationship between the level of economic activity in the economy and institutional enrollments during

the 1970s. Similarly, Tierney (1982) found a positive relationship between participation rates and unemployment. Simply stated, college attendance is viewed by many potential students as an alternative to unemployment. Therefore, it is expected that institutional enrollments will increase as economic conditions deteriorate.

Taken together, these four factors provide a general outline of the college and university enrollment environment. They define that supply of new traditional, full-time students and the environmental conditions that affect the decision of potential students on whether to attend college. Generally, it is expected that an increasing supply of potential students, increasing resource availability to potential students, and lower levels of economic wealth and activity will positively effect year-to-year changes in institutional enrollments.

Institutional Factors

While these demographic and economic factors have been shown to have a significant impact on enrollments, institutional factors will affect each institution's sensitivity to changing environmental conditions. In other words, environmental conditions are likely to have more of an impact on some institutions' enrollments than on others because of the way institutions position themselves within the environment. The five institutional factors selected for inclusion in this study represent aspects of the institution's domain of operation (Meyer, 1975), or of the market that the institution serves. These factors are: 1) program emphasis, 2) size of the region served, 3) admissions selectivity, 4) type of clientele served, and 5) price. The effects of each of these factors on institutional enrollments are discussed in the following sections.

1. Program emphasis. Students interests in fields of study vary over time. During the late 1960s student preferences began to shift away from the liberal arts and sciences, education, and theological training to the professions and applied sciences (National Center for Education Statistics, 1980: 131). Many institutions adapted to changing student interests by adding programs and by reallocating resources to existing programs in which interest was increasing. For example, an analysis of HEGIS earned degree data shows that the number of masters' degrees awarded in management and business administration increased from 11,728 degrees in 1971-72 to 30,056 degrees in 1979-80. Similarly, the number of institutions awarding such degrees increased from 191 institutions in 1971-72 to 384 institutions in 1979-80. Thus the general expectation is that institutions offering programs in areas of increasing student interests are less likely to experience declining enrollments than are institutions with an emphasis in areas of declining interest.

2. Size of recruiting area. The size of the area from which an institution recruits students is likely to affect its sensitivity to the effects of demographic and economic factors (Zammuto, 1983). As state-by-state analysis of demographic trends shows, some states will experience a greater decrease in the size of the 18-21 year old population than will others (for example, see McConnell, 1979). Similarly, economic conditions vary on a state-by-state basis. During the 1980-83 recession, for example, states with a heavy concentration in manufacturing industries had higher levels of unemployment than did other states, particularly those with a concentration in high technology and service industries. If an institution draws its

students from a diverse geographic area, it is likely to be less sensitive to localized changes in demographic and economic conditions than is a comparable institution recruiting students from a more concentrated area. Therefore, it is expected that the broader the geographic area that an institution recruits from, the smaller the year-to-year variations it will experience in enrollments as a result of fluctuating environmental conditions.

3. Selectivity. The results of several research studies (e.g., Astin and Henson, 1977) suggest that an institution's selectivity in admitting students will be related to changes in enrollment. For example, Leslie et al. (1981) and Brown et al. (1979) found that the enrollments of more selective research universities and liberal arts colleges were less prone to decline than were the enrollments of less selective institutions. Similarly, the Carnegie Council (1980) predicted that less selective liberal arts institutions are the most vulnerable to declining enrollments during the 1980s, a prediction reflecting both the factors of program emphasis and selectivity. Davis (1975) suggests that selectivity will also be a factor in enrollment change as competition between institutions for potential students increases. He argues that as competition increases, students will "shop up" from less selective to more selective institutions, which would be negatively reflected in the enrollments of the less selective institutions. Thus the literature suggests that admissions selectivity will be positively related to increases in institutional enrollments.

4. Type of clientele served. The literature suggests that an institution's relative emphasis on full-time versus part-time students is an important determinant to a declining traditional college-age

student population. Leslie and Miller (1974), for example, have suggested that one potential institutional response to declining full-time enrollments is increasing the enrollments of typically older, part-time students. Indeed, part-time enrollments have become an increasingly important part of aggregate institutional enrollments during the 1970s. For example, Mingle (1981) reported that older, part-time students comprised 51 percent of the 2.4 million increase in aggregate institutional enrollments between 1970 and 1978. The Carnegie Council (1980) has also reported that a substantial number of colleges and universities have modified their programs and schedules in order to attract part-time students. Thus it is expected that the greater an institution's emphasis on part-time enrollments, the more likely the institution is to exhibit increases in year-to-year enrollments as compared to institutions that primarily recruit traditional, full-time students.

5. Price. Jackson and Weathersby (1975) concluded from their review of studies examining the relationship between price and the demand for higher education that a negative relationship exists between price and the probability that a student will attend a particular institution. Thus, as a general relationship, it is expected that institutions that charge higher tuition and fees are more likely to experience declining enrollments than those with lower tuition and fees. We expect this effect to be most pronounced in the private sector which typically charges higher tuition fees.

METHODOLOGY

Several considerations influenced the analytical design employed in this study. First, we were primarily interested in determining how enrollments are affected by environmental and institutional conditions. This would enable us, for example, to determine the likely effect of humanities emphasis in two schools that differed only on this dimension. Or, the likely effect of a change in humanities emphasis, other things remaining the same.

Second, we believed that enrollments during any given year were determined, in large part, by enrollments during the preceeding year. While not indicative of a causal relationship, this notion is supported by high correlations, greater than .98, between enrollments at time (t) and enrollments at time (t-1), for all study groups.

Third, it seemed reasonable to assume that the relationship between the endogenous and exogenous variables should be invariant for relatively short periods of time. For example, there was no reason to assume that the effect of selectivity on enrollment should change in any meaningful way during the course of six years.

On evaluation of these considerations it seemed that the most appropriate means of achieving our study objectives was to employ a pooled cross-section time-series multiple regression design. The design readily accommodated our first and last concerns. And, by including a lagged enrollment variable would provide some insight into the effect of enrollment inertia.

However, numerous problems attend the use of a pooled cross-section time-series design. Data analyzed with this type of design are subject to problems associated with heteroscedasticity and

autocorrelation. Following Kmenta (1971: 508), the regression model for such data may be written as,

$$Y_{it} = \beta_1 X_{it,1} + \beta_2 X_{it,2} + \ldots + \beta_k X_{it,k} + \varepsilon_{it} \quad (i=1,2,\ldots,N;\ t=1,2,\ldots,T)$$

The sample data are represented by observations on N cross-section units over T periods of time. The assumptions of the classical linear regression model require that

$$E(\varepsilon_{it})^2 = \sigma_\varepsilon^2 \quad \text{for all } i \quad \text{(homoscedasticity)}$$

$$E(\varepsilon_{it}\,\varepsilon_{jt}) = 0 \quad \text{for all } i \neq j \quad \text{(cross-sectional independence)}$$

$$E(\varepsilon_{it}\,\varepsilon_{it-1}) = 0 \quad \text{(non-autocorrelation)}$$

However, as a consequence of combining time-series and cross-section data, disturbances may be time-series related (i.e., autocorrelated), cross-sectionally related (i.e., heteroscedastic), and a combination of both.

Fortunately, several statistical procedures have been suggested for dealing with such problems. These include application of generalized least squares models, error components models, and covariance models (Kmenta, 1971; Pindyck and Rubinfeld, 1981; Fuller and Battese, 1974; Maddala, 1971; Zellner, 1962). The covariance model was adopted for this study because: 1) it yields estimates which are unbiased, consistent, and asymptotically efficient (Hannan and Young 1977); 2) it yields estimates which are at least as good as those derived from the other procedures (Balestra and Nerlove, 1966; Wallace and Hussain, 1969; Maddala, 1971; Hannan and Young, 1977); and 3) unlike the other procedures, the model could be implemented with statistical routines that were readily available to us and which could

accommodate large datasets. The complete dataset contained more than 12,000 observations which made use of the other procedures almost impossible for cost and computational reasons.

The covariance model employed is essentially an ordinary least squares paradigm with dummy variables for each cross-section unit. The dummy variables serve to adjust both endogenous and exogenous variables for differences in the average enrollment level of each cross-section unit--which, if otherwise unaccounted for, would lead to serious heteroscedasticity.

Judge, Hill, Griffiths, Lutkepohl, and Lee (1982: 480) demonstrate that the use of dummy variables in this model is equivalent to computing cross-section unit means for each variable and then applying ordinary least squares to the deviations of each observation around its corresponding unit means. This procedure is virtually mandatory when N is large because of the computational problems that arise from having to invert the data matrix. Data treated in this manner have essentially been subjected to a transformation which partials the dummy covariates out of both the endogenous and exogenous variables. The resulting deviation or residual scores may then be analyzed with a simple ordinary least squares model. Resulting estimates must, however, be corrected for 1) degrees of freedom lost to dummy covariate estimation, and 2) reduced variable standard deviations resulting from the use of deviation scores as opposed to raw scores. Tests for autocorrelation of the error term suggested that corrections for this potential problem were unnecessary.

Two sets of independent variables were used to model enrollments. As noted in the previous section five factors were used to describe

environmental conditions. The variables used to operationalize these concepts were: 1) the number of 18 year olds in the state in which an institution was located (size of the pool of potential new students), 2) the unemployment rate for the state in which an institution was located (level of economic activity), 3) the constant dollar average weekly earnings for the state in which an institution was located (level of economic wealth), 4) state aid to higher education in constant dollars (availability of resources for individuals wishing to enroll), 5) federal aid to higher education in constant dollars (availability of resources for individuals wishing to attend). The nature of the first four variables were such that every institution in the same state had the same score in a given year. All institutions were assigned the same value for federal student aid for a given year.

The second set of factors represented an institution's position within its environment, or the institution's domain (Meyer, 1975; Miles and Cameron, 1982). The five variables used to operationalize institutional domain were: 1) the ratio of part-time to total students (type of clientele served), 2) in-state undergraduate tuition and fees (price), 3) institutional average total SAT verbal and math scores for entering freshmen (selectivity), 4) percent of institutional degrees in the humanities, social sciences, and education (program emphasis), and 5) the ratio of in-state undergraduate full-time equivalent (FTE) students to total FTE students (market scope).

A lagged enrollment variable was also included as a predictor. This was done because enrollment at an institution was assumed to be, in part, a function of its value at previous points in time. Models including such terms are referred to as dynamic lag models (Nerlove,

1971). Operational descriptions of the variables, level of aggregation, and data sources are described in Table 2.

Inclusion of the lagged enrollment variable serves two purposes. First, since the dummy covariates serve to control for differences in average enrollment level, this variable serves to control for the effect of overall institutional size on year-to-year changes in enrollment. That is, it controls for the fact that a 1% change in enrollment in a large institution translates into many more students than a 1% change in a small institution. Estimated effects of the remaining (truly) exogenous variables on enrollment are, therefore, free of the effects of differences in average and overall enrollment size.

Second, the coefficient may be interpreted as an estimate of the inertia in the system. It suggests both the degree to which enrollments at time (t) are a function of enrollments at time (t-1)--other things being equal; and, the extent to which enrollment gains (or losses) at time (t) may be predicted from enrollment gains (losses) at time (t-1).

Ths study sample included all colleges and universities which reported HEGIS data between the academic years 1975-76 and 1980-81. Separate analyses were run for public and private institutions in both the two and four-year sectors. Separate analyses were also performed for major doctoral, general baccalaureate, and comprehensive schools in the four-year sector. The number of schools in each study category are reported in Table 3 along with the percentage that each cell is of its row. The reader is reminded that each institution contributed one observation to the analysis for each year in which it reported complete

Table 2

Variables in the Analysis

Conceptual Variable	Operational Form	Level of Aggregation	Data Source
DEPENDENT VARIABLE:			
FTE Enrollments	Full-time headcount + part-time FTEs	Institutional	HEGIS Opening Fall Enrollments Survey
ENVIRONMENTAL VARIABLES:			
1. Pool of potential new students	Size of the 18 year-old population	State	U.S. Bureau of the Census (unpublished data)
2. Level of economic wealth	Annual average weekly earnings (1972 constant dollars)	State	U.S. Bureau of Labor Statistics, 1980; U.S. Bureau of the Census, 1981
3. Level of economic activity	Annual average unemployment[1]	State	U.S. Bureau of Labor Statistics, 1980; U.S. Bureau of the Census, 1981
4. Resource availability--I	State student aid per student (1972 constant dollars)	State	National Association of State Scholarship and Grants Programs
5. Resource availability--II	Federal student aid (1972 constant dollars)	National	Frances, 1980b
ORGANIZATIONAL VARIABLES:			
1. Clientele served	Part-time student FTEs/Total student FTEs	Institutional	HEGIS Opening Fall Enrollments Survey
2. Price	In-state tuition and fees	Institutional	HEGIS Institutional Characteristics Survey

Conceptual Variable	Operational Form	Level of Aggregation	Data Source
3. Selectivity	Average math and verbal SAT scores for entering freshmen[2]	Institutional	Higher Education Research Institute (see Astin and Henson, 1977)
4. Program Emphasis	Percent degrees in the humanities, social sciences, and education	Institutional	HEGIS Earned Degree Survey
5. Market Scope	Percent in-state students[3]	Institutional	HEGIS Residency and Migration Survey
6. FTE Enrollments$_{t-1}$	Full-time headcount + part-time FTEs	Institutional	HEGIS Opening Fall Enrollment Survey

[1]The annual unemployment rate for each state was logged for this analysis. Tierney (1982) showed that the logged value of unemployment provided a better empirical and theoretical fit for the relationship between unemployment and participation rates during the 1970s.

[2]Selectivity data were available for 1973 and 1977. The values for the intervening years were interpolated. Data for later years were extrapolated using the data for 1973 and 1977 to determine institutional trends.

[3]Data were available for all students in an institution for 1972-73 and for incoming students during 1978-79. Interpolation of values for the intervening years was expected to provide an indication of the relative extent to which an institution increased or decreased its recruiting area beyond the state in which it was located.

Table 3

Study Sample

	2-Year	4-Year	Major Doctoral	General BA	Comprehensive
Public	(1) 740 63.5%	(2) 425 36.5%	(3) 104 8.9%	(4) 112 9.6%	(5) 209 17.9%
Private	(6) 162 17.3%	(7) 774 82.7%	(8) 56 6%	(9) 585 62.5%	(10) 133 14.2%

data between 1975-76 and 1980-81. Hence, an institution with complete data in all years contributed six observations.

Results

Concatenating six years of data produced 12,142 observations for 2,101 unique institutions (i.e., cross-section units). Approximately 96% of these schools had complete data in all six of the years on which the study was based. In all, ten separate regression analyses were run. One for each cell in Table 3. Separate analyses for the combined public sample, and the combined private sample were not performed. The differences in the composition of these groups obviated any meaningful comparisons--e.g., 63.5% of all public schools were in the two-year sector, compared to 17.3% in the private sector; 62.5% of all private schools were in the general baccalaureate sector, as compared to 9.6% of all public institutions. While separate analyses were performed for public and private four-year schools (cells 2 and 7), differences in the composition of these groups requires cautious interpretations of comparisons between them.

Subsequent discussions of the effects of institutional and environmental variables will be based on the following comparisons:

(1) Public 4-year vs. Private 4-year (cells 2 and 7).

(2) Public 2-year vs. Private 2-year (cells 1 and 6).

(3) Public 4-year vs. Public 2-year (cells 1 and 2).

(4) Private 4-year vs. Private 2-year (cells 6 and 7).

(5) Public: Major Doctoral vs. General BA vs. Comprehensive (cells 3, 4, and 5).

(6) Private: Major Doctoral vs. General BA vs. Comprehensive (cells 8, 9, and 10).

Four-Year Institutions

Results

The results of the regression analyses for public and private four-year institutions are shown in the first two columns of Table 4. Changes in squarred multiple correlations for specified step-down models are shown in parentheses in each column. Changes in R-square allow the researcher to examine the contribution of different variables or sets of after controlling for those previously entered. The use of the procedure has no effect on the estimation of coefficients once all variables have been entered.

By virtue of the mathematical procedure employed, the dummy covariates were entered first. The one major drawback of the computational procedure used is that there is no way of obtaining an estimate of the multiple correlation between the endogenous variable and the dummies. At the same time, however, we observed that the correlations between the current and the lagged enrollment variables were always greater than (.98). We can be certain, therefore, that the minimum total R-square for complete models was at least (.96). The lagged enrollment variable was entered next, followed by the environmental variables. The organizational-level variables were entered on the last step.

Simple counts of the number of significant coefficients in the first and second columns of Table 3 suggest that the enrollments of public four-year institutions are more influenced by institutional and environmental conditions than are those in the private sector. Statistically significant variables in the public sector include:

Table 4

Estimated Unstandardized Regression Coefficients

Variables	Sector			
	Four-year		Two-year	
	Public (n=425 nt=2527)	Private (n=774 nt=4578)	Public (n=740 nt=4159)	Private (n=162 nt=856)
FTE Enrollment at Time t-1	.52**	.48**	.24**	.23**
Change in R-square	(.36)	(.25)	(.08)	(.12)
Environmental Variables				
Federal Student Aid	.15**	.03**	-.01	.01
State Student Aid	.25	-.14	-.53	.03
Size of the 18 year old population	-3.33	-.80	-11.74**	-1.53
Annual average weekly earnings	-6.25**	-.07	-4.92**	-.78
Annual average unemployment	254.72**	-.20	101.68	-5.91
Change in R-square	(.02)	(.01)	(.03)	(.04)
Organizational Variables				
Percent part-time FTE	22.28**	.73	9.88**	-.71
Percent degrees in humanities, social science, and education	4.52	-2.3**	-.01	-.09
In-state tuition and fees	-.67**	-.02	.01	.02
Average freshmen SAT score	1.22*	.03	3.73	-.45
Percent in-state students	3.53	-1.16	-2.05	2.60**
Change in R-square	(.02)	(<.01)	(.02)	(.01)

* $p \leq .05$
** $p \leq .01$

(1) Lagged enrollment (b=.52).

(2) Annual average weekly earnings (b=-6.25).

(3) Percent part-time FTE (b=22.28).

(4) In-state tuition and fees (b=-.67).

(5) Average freshman SAT score (b=1.22).

(6) Federal student aid (b=.15).

(7) Annual average unemployment (b=254.72).

The coefficients in this and all subsequent lists are reported in order of their relative effect on enrollment as determined by the magnitude of the standardized regression coefficients. Only three variables were statistically significant in the private sector:

(1) Lagged enrollment (b=.48).

(2) Humanities emphasis (b=-2.3).

(3) Federal student aid (b=.03).

Discussion

The coefficients for the lagged enrollment variable (.52 and .48, for the public and private sectors, respectively) emerge as having the strongest relative effect on current enrollments after controlling for differences in average enrollment levels (that is, the dummy covariates). The change in R-square associated with these coefficients indicates that between one-quarter and one-third of enrollment variance is explained by an inertia factor.

Coefficients for federal student aid were significant in both the public (b=.15) and private (b=.03) sectors. Differences in the relative magnitudes of these coefficients suggest that federal student aid has a much greater impact on enrollments in the private sector.

This conclusion may be spurious for several reasons; one of which demonstrates the pitfalls open to the researcher who fails to understand the potential consequences of combining units of analysis which go by the same name (in this case "colleges and universities"), but which have very different underlying structures.

Subsequent analyses demonstrate that the exogenous variables included in this study have very different interrelationships in each of the groups shown in Table 3. The coefficients for federal student aid are almost equal for both the public and private major doctoral sectors, and the public and private comprehensive sectors. However, federal student aid is not significant in the private general baccalaureate sector--which, as shown in Table 2, comprises 75% of the private four-year study group. If this study serves to demonstrate only one point, we hope it is that researchers in higher education should be extremely cautious about performing studies that simply assume that "colleges and universities," like mice in a laboratory, have similar underlying dynamics.

Second, as previously noted, every institution was assigned the same value for federal student aid for a given year. Hence, the effect of student aid on a single school cannot be determined from the data.

In accord with the results of past research, both unemployment (b=254.72) and average weekly earnings (b=-6.25) demonstrated a significant relationship with enrollment in the public sector. The lack of similar effects in the private sector may be due to the fact that these institutions recruit more students from higher income families (e.g., Astin, King and Richardson, 1980). In any case, private four-year institutions appear to have been insulated from the

effects of the environmental conditions tested in this analysis during the latter half of the 1970s.

The only institutional-level variable that was significant in the private sector was the percent of degrees in the humanities, social sciences, and education (b=-2.3). The enrollments of public institutions, on the other hand, showed a significant relationship with tuition charges (b=-.67), part-time student education (b=22.28), and selectivity as measured by average freshman SAT scores (b=1.22).

In summary, the results of these analyses suggest that enrollments in four-year public institutions during the latter half of the 1970s increased as the level of unemployment increased, and decreased as the level of economic wealth in an area (average weekly earnings) increased. The enrollments of private institutions, on the other hand, appeared to be insulated from the effects of these events. Enrollments of institutions in both sectors appeared to be significantly affected by the availability of federal student aid.

The results of these analyses also suggest that enrollments of public institutions were more affected by institutional characteristics than their counterparts in the private sector. Other things being equal, public institutions experienced reduced enrollments with tuition increases, and benefited to the extent they were more selective and served part-time students. The only institutional-level variable that was significant in the private sector was the percent of degrees in the humanities, social sciences, and education. The negative coefficient for this variable suggests that the greater a private institution's concentration in these areas, the lower its enrollments.

The model R-squares reported in Table 4 suggest that the institutional and environmental variables included in the model were better predictors of enrollment in the public sector than in the private sector. More important, however, the small overall contributions to the model R-squares by these variables, generally less than 4%, suggests that idiosyncratic institutional differences not captured by the model represent the most powerful factors influencing enrollment.

Two-Year Institutions

Results

Estimated regression coefficients for two-year public and private institutions are shown in columns three and four of Table 4, respectively. Statistically significant predictors in the public sector include:

(1) Number of 18 year olds in the state (b=-11.74).

(2) Lagged enrollment (b=.24).

(3) Annual average weekly earnings (b=-4.92).

(4) Percent part-time FTE (b=9.88).

(5) Annual average unemployment (b=101.68).

Only two variable were statistically significant in the private sector:

(1) Lagged enrollment (b=.23).

(2) Percent undergraduate in-state enrollment (b=2.60).

Discussion

Again, environmental variables appear to play a more influential role in the public sector. The results of the analyses indicate that

the enrollments of public sector schools are significantly related to unemployment conditions (b=101.65), and annual average weekly earnings (b=-4.92). At first glance one of the most counter-intuitive findings in the entire study was the significant negative regression coefficient for the size of the 18 year old population (b=-11.74). The sign of the coefficient suggests that enrollments decreased as the number of 18 year olds in the population increased. In fact, what actually happened was that the number of 18 year olds actually decreased between 1975-76 and 1980-81, while the number of students attending two-year schools increased. This explanation is supported by the data as well as earlier studies by Thrift and Toppe (1982), Hodgkinson (1983), and Zammuto (1983).

The only organizational level variable that was significant in the public sector was the percent of part-time FTE (b=9.88). This suggests that institutions in this sector benefitted to the extent that they accommodated part-time students. The only organizational level variable that was significant in the private sector was the percent of in-state students served (b=2.6). This suggests that enrollments in private two-year schools were directly related to their ability to draw from local communities.

The lagged enrollment variable was significant in both the public and private sectors (b=.24 and .23, respectively). The R-square change coefficients for these variables indicate they account for between eight and twelve percent of enrollment variation after controlling for differences in average institutional enrollment levels. The results of the step-down analyses indicate environmental and institutional factors account for about five percent of enrollment variation after

controlling for initial enrollment differences and enrollment inertia (that is, the lagged enrollment variable).

In summary the results of these analyses suggest that enrollments in two-year public institutions are primarily affected by economic conditions. And, only marginally affected by the organizational level variables included in the regression model.

Enrollments in private sector schools were not generally influenced by either the environmental or organizational variables included in the study. The one exception being the positive relationship between enrollment level and percent in-state students.

Differences Between the Two and Four-Year Sectors

Public Sector

In retrospect, differences and similarities between the public two and four-year sectors seem quite reasonable in view of their structure and clientele. That is, enrollments in both groups are directly affected by changes in the economic environment. And, while Federal student aid, tuition levels, and selectivity are significant predictors in four-year schools, the generally lower costs of attending two-year schools and their open-enrollment policies would seem to obviate these variables as important predictors of enrollment.

The R-square change coefficients indicate that lagged enrollment accounts for 36% of enrollment variation in the four-year sector after controlling for average enrollment differences, and only 8% in the two-year sector. Thus, enrollment inertia appears some four times stronger in the four-year sector than in the two-year sector.

Private Sector

Enrollments in both the four and two-year sectors appear only marginally related to the organizational and environmental variables included in the model. Idiosyncratic or environmental and organizational factors not included in the models employed appear to drive enrollments in these sectors.

Public Four-Year Institutions

Results

The results of the regression analyses for public major doctoral, general baccalaureate, and comprehensive institutions are reported in Table 5. Simple counts of the numbers of significant variables in each sector suggest that enrollments at major doctoral and comprehensive institutions are more sensitive to environmental and institutional conditions than are general baccalaureate schools.

Major Doctoral Institutions: Statistically significant variables include:

(1) Lagged enrollment (b=.42).

(2) Annual average weekly earnings (b=-13.92).

(3) Average freshman SAT score (b=4.75).

(4) Percent part-time FTE (b=62.55).

(5) Humanities emphasis (b=35.48).

(6) Percent undergraduate in-state enrollment (b=34.34).

(7) Federal student aid (b=.36).

Discussion

Organizational level variables appear to dominate the list. The R-square change coefficient for the lagged enrollment variable

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Table 5

Estimated Unstandardized Regression Coefficients

Variables	Sector					
	Public Four-year			Private Four-year		
	Major Doctoral (n=104 nt=611)	Comprehensive (n=209 nt=1236)	General BA (n=112 nt=658)	Major Doctoral (n=56 nt=321)	Comprehensive (n=133 nt=781)	General BA (n=585 nt=3454)
FTE Enrollment at Time t-1	.42**	.56**	.46**	.38**	.36**	.62**
Change in R-square	(.26)	(.50)	(.27)	(.26)	(.16)	(.38)
Environmental Variables						
Federal Student Aid	.36**	.17**	.04*	.35**	.24**	-.01
State Student Aid	.13	-.11	-.16	-.06	-.84	-.11
Size of the 18 year old population	5.21	-11.87**	-6.59	-9.01	-8.89	.56
Annual average weekly earnings	-13.92**	-4.46**	-1.60	-3.23	1.67	-.43
Annual average unemployment	174.76	287.85**	144.31**	10.99	-92.97	-2.34
Change in R-square	(.04)	(.02)	(.03)	(.08)	(.03)	(<.01)
Organizational Variables						
Percent part-time FTE	62.55**	19.82**	7.23*	44.74**	-.90	.98
Percent degrees in humanities, social science, and education	35.48*	1.32	.28	-11.39	.65	-2.22**
In-state tuition and fees	.07	-1.53**	-.14	-.37**	-.30**	.01
Average freshmen SAT score	4.75*	.48	.35	-1.75	.64	-.02
Percent in-state students	34.34*	-.94	-1.13	21.01	2.66	-.23
Change in R-square	(.05)	(.03)	(<.01)	(.05)	(.03)	(<.01)

* $p \leq .05$
** $p \leq .01$

indicates that about 26% of an institution's current enrollments are explained by the previous year's enrollments after controlling for differences in average institutional enrollments.

The second most powerful predictor was annual average weekly earnings (b=-13.92). This finding surprised us. Our beliefs about the characteristics and aspirations of students attending major doctoral institutions were such that we did not believe their decisions to matriculate would be significantly influenced by short-term market conditions in the form of average weekly earnings. The significant negative coefficient for this variable indicates this was not the case. The sign of the coefficient indicates that enrollments in these schools were adversely affected by improved economic conditions. And, furthermore, that many persons who qualify to matriculate in these institutions chose to work instead of attending school as employment conditions improved.

Institutional selectivity, as measured by average entering freshman SAT socres, was the third most influential variable in the model (b=4.75). The coefficient indicates that between 1975-76 and 1980-81 more selective major doctoral institutions experienced larger enrollment gains than less selective institutions after controlling for the other variables in the model.

The other significant organizational level variables were the percent part-time FTE (b=62.55), humanities emphasis (b=35.48), and the percent of undergraduate in-state students (b=34.34). The coefficients for these variables indicate that institutional enrollments increased to the extent they (1) offered programs for part-time students; (2) were humanities oriented; and (3) served in-state students.

The significance and sign of the in-state students variable (b=34.34) surprised us. We expected that major doctoral institutions would benefit to the extent they served students from wider geographic regions. This does not appear to be the case. The phenomenon may be due, at least in part, to declining economic conditions during the period. That is, it is less costly to attend a public college in one's own state, than a public or private college of equal merit in a different state.

The level of federal student aid is the weakest, albeit, statistically significant predictor in the model. As may be seen in Table 4, this variable is statistically significant in all three sectors. The magnitude of the federal student aid coefficients suggest that enrollments in major doctoral schools were about twice as sensitive to federal student aid as those in comprehensive institutions. And, about eight times as sensitive as enrollments in general baccalaureate institutions.

Comprehensive Institutions: Estimated regression coefficients for public comprehensive institutions are shown in column 2 of Table 4. Statistically significant coefficients include:

(1) Lagged enrollment (b=.56).

(2) Number of 18 year olds in the state (b=-11.87).

(3) Undergraduate tuition and fees (b=-1.53).

(4) Percent part-time FTE (b=19.82).

(5) Annual average weekly earnings (b=-4.46).

(6) Federal student aid (b=.17).

(7) Annual average unemployment (b=-287.85).

The R-square change coefficient for the lagged enrollment variable indicates that the variable accounts for about 50% of the variation in current enrollments. The second most influential predictor in this set is the number of 18 year olds in the state (b=-11.87). The sign of the coefficient reflects the fact that enrollments increased during the study period while the number of 18 year olds decreased. We assume this was due, at least in part, to the poor economic conditions of the period.

The significant negative coefficient for undergraduate tuition (b=-1.53) suggests that, in general, each $100 increase in tuition reduced enrollments in institutions by some 153 students. This result takes on additional meaning in view of the facts that (1) this was the only group in the public sector in which tuition was significant; and (2) both the average weekly earnings variable and unemployment variables were significant predictors. Apparently, enrollments of public comprehensive institutions are very sensitive to general economic conditions.

In addition, recent articles in the Chronicle of Higher Education indicate that the cost of attending public institutions (that is, tuition and fees, room and board, and other expenses) will increase about 9% or $400 between 1982-83 and 1983-84. While our analyses focused only on tuition and fees, this rise in total costs portends the strong possibility that many institutions may suffer substantial enrollment losses in the coming year.

The only other significant institutional level variable was the percent part-time FTE (b=19.82). Apparently, enrollments of institutions in this sector were directly related to the extent the

institution accommodated part-time students. As previously noted, the coefficients for both annual average weekly earnings (b=-4.46) and average unemployment (b=287.85) were statistically significant predictors. Their signs indicate that enrollments increased as economic conditions deteriorated. Federal student aid was also identified as a significant predictor (b=.36). The coefficients in Table 4 indicates that when either of the economic-condition variables were significant, federal aid was also significant.

General Baccalaureate: Estimated regression coefficients for public general baccalaureate institutions are shown in column 3 of Table 4. Statistically significant coefficients include:

(1) Lagged enrollment (b=.46).

(2) Percent part-time FTE (b=7.23).

(3) Annual average unemployment (b=144.31).

(4) Federal student aid (b=.04).

Discussion

The R-square change coefficient for the lagged enrollment variable indicates that the variable accounts for about 27% of the variation in current enrollments. The second most powerful predictor was the percent part-time student FTE (b=7.23).

As found in the previous analysis, both unemployment conditions (b=144.3) and federal student aid (b=.04) were significant factors influencing institutional enrollments.

Differences Between Four-Year Public Sector Groups

The patterns of significant coefficients in Table 4 suggest the following:

(1) More organizational-level variables are significant in the major doctoral sector than either of the other two sectors.

(2) Institutions in all three study groups profited by offering programs which accommodated part-time students.

(3) Enrollments in all three study groups were significantly affected by economic conditions. The enrollments of comprehensive institutions appear to be the most sensitive--with five of the six economic variables included in the model statistically significant.

Private Four-Year Institutions

The results of the regression analyses for the private major doctoral, comprehensive, and general baccalaureate sectors are reported in the last three columns of Table 4. The pattern and number of significant coefficients suggest that enrollments in this sector are less sensitive to changes in both environmental and institutional conditions than are their counterparts in the public sector. For example, neither annual average unemployment nor annual average weekly earnings are significant in any private sector group--while at least one if not both are significant in each public sector group.

Major Doctoral Institutions: Statistically significant variables include:

(1) Lagged enrollment (b=.42).

(2) Undergraduate tuition and fees (b=-.37).

(3) Percent part-time FTE (b=44.74).

(4) Federal student aid (b=.35).

The R-square change coefficient for the lagged enrollment variable indicates the variable accounts for about 26% of the variation in current enrollments after controlling for differences in average institutional enrollments. The second most powerful predictor is undergraduate tuition and fees (b=-.37). The coefficient suggests that each $100 increment in tuition and fees was associated with an enrollment reduction of about 37 students--other things being equal. Recent articles in the Chronicle of Higher Education indicate that the cost of attending private institutions is likely to increase by 10 percent, or $800 between 1983 and 1984. Again, our data suggest that without significant changes in the costs of attending private doctoral institutions, there are likely to be substantial enrollment losses in the coming years.

In view of the significant relationship between tuition and fees and enrollment level, it is not surprising to find that federal student aid significantly affects enrollment in private major doctoral institutions (b=.35). The coefficient is approximately equal to that for public major doctoral institutions (b=.36).

The remaining significant variable was the percent part-time FTE (b=44.76). Again, suggesting that institutions that accommodate part-time students experience higher total FTE enrollments than institutions which do not.

Comprehensive Institutions: Statistically significant variables include:

(1) Lagged enrollment (b=.36).

(2) Federal student aid (b=.24).

(3) Undergraduate tuition and fees (b=-.30).

The most influential predictor in the analysis is lagged enrollment (b=.36). The second most important predictor is federal student aid (b=.24). The level of tuition and fees is the only other significant predictor (b=-.30). The value of this coefficient suggests that a $100 increment in tuition and fees will, on average, reduce enrollments by about 30 students.

General Baccalaureate Institutions: Only two variables were statistically significant predictors in this study group: (1) lagged enrollments (b=.61); and (2) humanities emphasis (b=-2.22). The negative coefficient on the humanities variables (b=-2.22) indicates that institutions in this sector experienced smaller enrollments as a function of their humanities program emphasis. Conversely, institutions benefited to the extent they emphasized and provided non-humanities oriented programs.

Differences Between Four-Year Private Sector Groups

Fewer individual environmental and organizational variables are significant in the private sector than in the public sector. However, those which are significant in the private sector generally account for more variation (as measured by the R-square change coefficients) in current enrollments than those in the public sector.

Federal student aid was identified as a significant determinant of enrollments in two of the three four-year study groups--major doctoral and comprehensive institutions. The level of in-state tuition and fees

was also significant in these groups. The negative sign on these coefficients lends further support to the significant role played by Federal student aid.

Enrollments at general baccalaureate institutions were unrelated to all but one of the exogenous variables in the model--humanities emphasis. The negative coefficient on this variable suggests that enrollments in schools with a strong humanities emphasis have been and will be on the wane.

FOOTNOTE

[1]The population ecology model has proved useful in studying different aspects of change within educational systems. For example, Birnbaum (1983) has used the model to study changes in the diversity of American higher education, and to examine the implications of these changes for the future viability of the higher education system. Nielsen and Hannan (1977) and Carroll (1981) have studied variations in enrollment growth across national educational systems using the population ecology model. Freeman and Hannan (1975) and Hannan and Freeman (1978) have applied the model to the study of differences in the organizational structure of school systems under conditions of enrollment growth and decline.

REFERENCES

Aldrich, H.E. Organizations and environments. Englewood Cliffs, N.J.: Prentice-Hall, 1979.

Astin, A.W. and Henson, J.W. "New measures of college selectivity," Research in Higher Education, 1977, 6, 1-9.

Astin, A.W., King, M.R., and Richardson, G.T. The American freshman: National norms for Fall 1980. Los Angeles: Cooperative Institutional Research Program, 1980.

Balestra, P. and Nerlove, M. "Pooling cross-section and time-series data in the estimation of a dynamic model: The demand for natural gas," Econometrica, 1966, 34, 585-612.

Becker, G.S. Human capital. New York: Columbia University Press, 1975.

Birnbaum, R. Maintaining diversity in higher education. San Francisco: Jossey-Bass, 1983.

Boulding, K. "The management of decline," Change, June 1975, 8-9.

Brittian, J.W. and Freeman, J.H. "Organizational proliferation and density dependent selection." In J.R. Kimberly and R.H. Miles (Eds.), The organizational life cycle. San Francisco: Jossey-Bass, 1980.

Brown, K., Grant, A., and Leslie, L. Patterns of enrollment in higher education: 1965 to 1977--Research universities. Tucson, Ariz.: Center for the Study of Higher Education, 1979.

Carnegie Council on Policy Studies in Higher Education. Three thousand futures: The next twenty years for higher education. San Francisco: Jossey-Bass, 1980.

Carroll, G.R. "Dynamics of organizational expansion in national systems of education," American Sociological Review, 1981, 46, 585-599.

Child, J. "Organizational structure, environment, and performance: The role of strategic choice," Sociology, 1972, 6, 2-21.

Davis, J.S. A survey of student values and choices. Brookdale, Calif.: College Entrance Examination Board, 1975.

Dresch, S.P. "Educational saturation: A demographic-economic model," AAUP Bulletin, Autumn 1975, 61, 239-247.

Frances, C. "Preparing for the 1980s: Apocalyptic vs. strategic planning," Change, July/August, 1980a, 12, 39-44.

Frances, C. "Influence of federal programs." In P. Jedamus and M.W. Peterson (Eds.), Improving academic management: A handbook of planning and institutional research. San Francisco: Jossey-Bass, 1980b.

Freeman, J. and Hannan, M.T. "Growth and decline processes in organizations," American Sociological Review, 1975, 40, 215-228.

Freeman, R.B. The over-educated American. New York: Academic Press, 1976.

Fuller, A.W. and Baltese, G.E. "Estimation of linear models with crossed-error structure," Journal of Econometrics, 1974, 2, 67-78.

Hannan, M.T. and Freeman, J. "The population ecology of organizations," American Journal of Sociology, 1977, 82, 929-964.

Hannan, M.T. and Freeman, J. "The internal politics of growth and decline." In M.W. Meyer (Ed.), Environments and organizations. San Francisco: Jossey-Bass, 1980.

Hannan, M.T. and Young, A.A. "Estimation in panel models: Results on pooling cross-sections and time series." In D.R. Heise (Ed.), Sociological Methodology. San Francisco: Jossey-Bass, 1977.

Hodgkinson, H.L. Guess who's coming to college: Your students in 1990. Washington, D.C.: National Institute of Independent Colleges and Universities, January 1983.

Hofer, C.W. and Schendel, D. Strategy formulation: Analytical concepts. St. Paul, Minn.: West Publishing, 1978.

Jackson, G.A. and Weathersby, G.B. "Individual demand for higher education: A review and analysis of recent empirical studies," Journal of Higher Education, 1975, 46, 623-652.

Judge, G.G., Hill, R.C., Griffiths, W., Lutkepohl, H., Lee, T. Introduction to the theory and practice of econometrics. New York: Wiley, 1982.

Kmenta, J. Elements of econometrics. New York: MacMillan, 1971.

Kotler, P. and Murphy, P.E. "Strategic planning for higher education," Journal of Higher Education, 1981, 52, 470-489.

Leslie, L.L. The role of public student aid in financing private higher education. Tucson, Ariz.: Center for the Study of Higher Education, 1978.

Leslie, L.L. "The financial prospects for higher education in the 1980s," Journal of Higher Education, 1980, 51, 1-17.

Leslie, L.L. and Miller, H.F., Jr. Higher education and the steady state. Washington, D.C.: ERIC/American Association for Higher Education, 1974.

Leslie, L.L., Grant, A., and Brown, K. Patterns of enrollment in higher education: 1965 to 1977—Liberal arts colleges. Tucson, Ariz.: Center for the Study of Higher Education, 1981.

Maddala, G.S. "The use of variance components models in pooling cross-section and time-series data," Econometrica, 1971, 39, 341-358.

McConnell, W.K. Projections of high school graduates in the west. Boulder, Colo.: Western Interstate Commission for Higher Education, 1979.

Meyer, M.W. "Organizational domains," American Sociological Review, 1975, 40, 599-615.

Miles, R.H. and Cameron, K.S. Coffin nails and corporate strategies. Englewood Cliffs, N.J.: Prentice-Hall, 1982.

Mingle, J.R. "Challenges of retrenchment." In J.R. Mingle (Ed.), Challenges of Retrenchment. San Francisco: Jossey-Bass, 1981.

Mingle, J.R. and Norris, D.M. Colleges respond to decline: Resistance versus application. Atlanta: Southern Regional Education Board, 1981.

National Center for Education Statistics. The condition of education 1980 edition. Washington, D.C.: Government Printing Office, 1980.

Nerlove, M. "Further evidence on the estimation of dynamic economic relations from a time series of cross sections," Econometrica, 1971, 39, 359-382.

Nielsen, F.D. and Hannan, M.T. "The expansion of national educational systems: Tests of a population ecology model," American Sociological Review, 1977, 42, 479-490.

Pindyck, D.S. and Rubinfeld, R.L. Econometric models and econometric forecasts. New York: McGraw-Hill, 1971.

Rowse, G.L. and Wing, P. "Assessing competitive structures in higher education," Journal of Higher Education, 1982, 53, 656-686.

Rusk, J.J., Leslie, L.L., and Brinkman, P.T. "Increasing impact of economic conditions upon higher education enrollments," Economics of Education Review, 1982, 2, 25-48.

Thrift, J.S. and Toppe, C. Diminished access: Fall 1982 enrollment at independent colleges and universities. Washington, D.C.: National Institute of Independent Colleges and Universities, December 1982.

Tierney, M.L. Trends in college participation rates. Boulder, Colo.: National Center for Higher Education Management Systems, 1982.

U.S. Bureau of the Census. "Projection of the population of the United States: 1975 to 2050," Current Population Reports, Series P-25, No. 601, October 1975.

U.S. Bureau of the Census. Statistical Abstract of the United States. Washington, D.C.: Government Printing Office, December 1981.

U.S. Bureau of Labor Statistics. Handbook of labor statistics. Washington, D.C.: Government Printing Office, December 1980.

Wallace, T.D. and Hussain, A. "The use of error component models in combining cross-section with time-series data," Econometrica, 1969, 37, 55-72.

Zammuto, R.F. "Organizational correlates of decline: Some preliminary analyses," Paper presented at the Association for Higher Education meeting, Washington, D.C., March 1982.

Zammuto, R.F. "Growth, stability and decline in American college and university enrollments," Education Administration Quarterly, 1983, 19, 83-99.

Zellner, A. "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias," Journal of the American Statistical Association, 1962, 57, 167-187.

Zemsky, R, Shaman, S., and Berberbich, M.A. "Toward an understanding of collegiate enrollments: A first test of the market segment model," Journal of Education Finance, 1980, 5, 355-374.